

CLAIMS:

1. A method of processing samples of a received signal to produce a demodulated signal, comprising the steps of:
representing an impulse response matrix for the
5 received signal using a plurality of indirect variables of a linear complex vector;
synchronizing to the received signal samples in dependence upon the indirect variables;
tracking the indirect variables for successive
10 received signal samples;
equalizing the successive received signal samples in dependence upon the tracked indirect variables; and
producing the demodulated signal in response to the equalized received signal samples.
- 15 2. A method as claimed in claim 1 wherein the received signal is a signal of a TDMA communications system.
3. A method as claimed in claim 2 wherein the step of synchronizing to the received signal samples comprises matched filtering the received signal samples to produce the plurality
20 of indirect variables, and determining a maximum of a function of the indirect variables to determine synchronization.
4. A method as claimed in claim 3 wherein there are four indirect variables and said function is a function of only two of the indirect variables.
- 25 5. A method as claimed in claim 1 wherein the step of tracking the indirect variables for successive received signal samples comprises recursively filtering initial values of the indirect variables, established during the synchronizing step, in dependence upon the successive received signal samples.

6. A method as claimed in claim 5 wherein said indirect variables are produced and tracked individually in respect of samples of a received signal from each of two spaced antennas, and received signal samples from the two antennas are combined and equalized in dependence upon a combination of the indirect variables in respect of the two antennas.

7. A method as claimed in claim 1 wherein the step of tracking the indirect variables for successive received signal samples comprises a step of estimating frequency offset in
10 dependence upon the successive received signal samples.

8. A method as claimed in claim 7 wherein said indirect variables are produced and tracked individually in respect of samples of a received signal from each of two spaced antennas, and received signal samples from the two antennas are combined and equalized in dependence upon a combination of the indirect variables in respect of the two antennas.

9. A method as claimed in claim 1 wherein the step of equalizing the successive received signal samples comprises adaptively changing an equalizer parameter in dependence upon tracking errors for successive received signal samples to reduce co-channel interference in the received signal.

10. A method as claimed in claim 9 wherein said indirect variables are produced and tracked individually in respect of samples of a received signal from each of two spaced antennas, and received signal samples from the two antennas are combined
25 and equalized in dependence upon a combination of the indirect variables in respect of the two antennas.

11. A method as claimed in claim 1 wherein said indirect
variables are produced and tracked individually in respect of
30 samples of a received signal from each of two spaced antennas,

and received signal samples from the two antennas are combined and equalized in dependence upon a combination of the indirect variables in respect of the two antennas.

12. Apparatus for producing a demodulated signal from
5 samples of a received signal, comprising:

a synchronization unit responsive to the received signal samples for producing a linear complex vector comprising a plurality of indirect variables having initial values corresponding to a synchronized state;

10 a tracking unit responsive to the initial values of the indirect variables and to the received signal samples to produce tracked values of the indirect variables for successive received signal samples;

an equalizer responsive to the tracked values of the
15 indirect variables to equalize successive received signal samples;

a feedback path from the equalizer to the tracking unit to facilitate producing the tracked values of the indirect variables by the tracking unit; and

20 a demodulator responsive to the equalized received signal samples to produce a demodulated signal.

13. Apparatus as claimed in claim 12 wherein the synchronization unit comprises a plurality of finite impulse response filters for matched filtering of the received signal
25 samples to produce the plurality of indirect variables.

14. Apparatus as claimed in claim 12 wherein the tracking unit comprises a recursive filter for recursively filtering the indirect variables in dependence upon the successive received signal samples.

30 15. Apparatus as claimed in claim 14 and including respective synchronization and tracking units for samples of a

received signal from each of two spaced antennas, wherein the equalizer is responsive to the tracked indirect variables for both antennas to combine and equalize the received signal samples from the two antennas.

5 16. Apparatus as claimed in claim 12 and including a frequency offset estimator coupled to the tracking unit for modifying the tracking of the indirect variables in accordance with estimated frequency offset in dependence upon the successive received signal samples.

10 17. Apparatus as claimed in claim 16 and including respective synchronization and tracking units for samples of a received signal from each of two spaced antennas, wherein the equalizer is responsive to the tracked indirect variables for both antennas to combine and equalize the received signal
15 samples from the two antennas.

18. Apparatus as claimed in claim 12 and including a unit, responsive to tracking errors determined by the tracking unit for successive received signal samples, for estimating an interference correlation matrix to adaptively change a
20 parameter of the equalizer to reduce co-channel interference in the received signal.

19. Apparatus as claimed in claim 18 and including respective synchronization and tracking units for samples of a received signal from each of two spaced antennas, wherein the
25 equalizer is responsive to the tracked indirect variables for both antennas to combine and equalize the received signal samples from the two antennas.

20. Apparatus as claimed in claim 12 and including respective synchronization and tracking units for samples of a
30 received signal from each of two spaced antennas, wherein the

Figure 6. The effect of the number of iterations on the accuracy of the proposed algorithm. The results are shown for different values of α and β . The x-axis represents the number of iterations (from 0 to 100), and the y-axis represents the accuracy (from 0.8 to 1.0). The legend indicates four cases: $(\alpha=0.9, \beta=0.9)$, $(\alpha=0.9, \beta=0.7)$, $(\alpha=0.7, \beta=0.9)$, and $(\alpha=0.7, \beta=0.7)$.

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